

PRELIMINARY DATA SUMMARY

August 1988

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

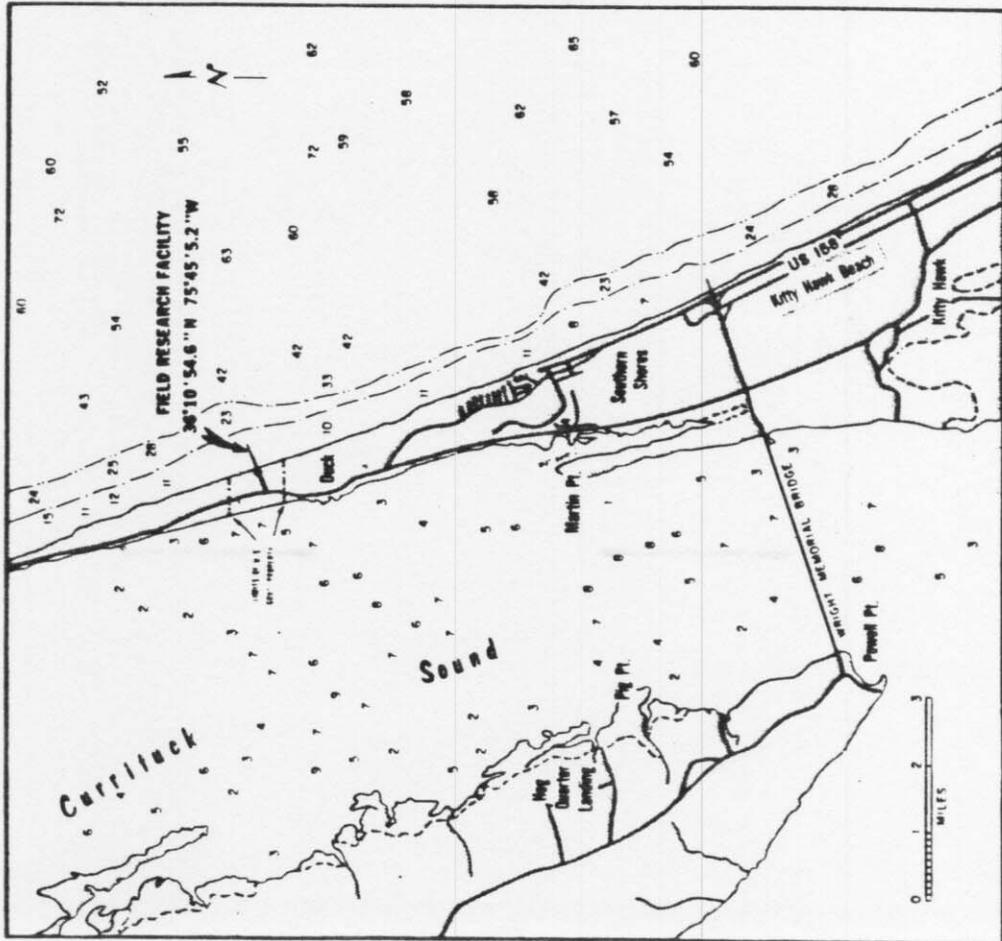
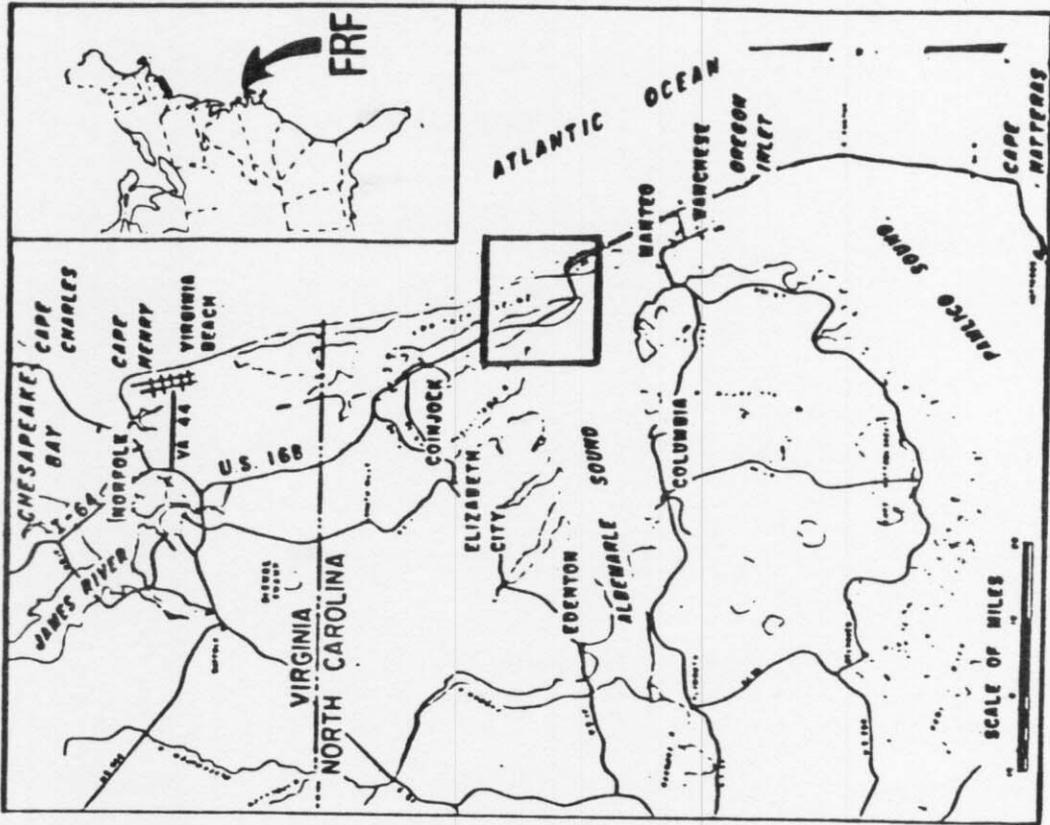


Figure 1. FRF location map

Table 1: Instrument Status/Data Availability

AUG 1988

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																														
				1	2	3	4	5	6	7	8	9	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3		
616	Barometric Pressure		Gage Status	*																														
			Data Collected	* /																														
			Analog Record	*																														
604	Precipitation		Gage Status	*																														
			Data Collected	* / * /																														
624	Air Temperature		Gage Status	*																														
			Data Collected	* /																														
632	Anemometer on Laboratory Building Elevation 19 m (NGVD)		Gage Status	*																														
			Data Collected	* /																														
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*																														
			Data Collected	* /																														
625	Baylor staff at station 19+00 on FRF pier	see Figure 7	Gage Status	*																														
			Data Collected	* /																														
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*																														
			Data Collected	* /																														
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*																														
			Data Collected	* / * /																														
679	Current meter 500 m south of FRF pier (0.5 km offshore)	see Figure 7	Gage Status	*																														
			Data Collected	* /																														
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*																														
			Data Collected	* /																														
Supplemental Observations (daily oceanographic and meteorological observations)			Daily observation	*																														

Gage Status
Operational = *
Partial = /
Non-Operational = -

Daily Observation
Complete = *
Partial = /
None = -

Analog Record
Complete = *
Partial = /
None = -

Data Collected
All = *
Partial = /
None = -

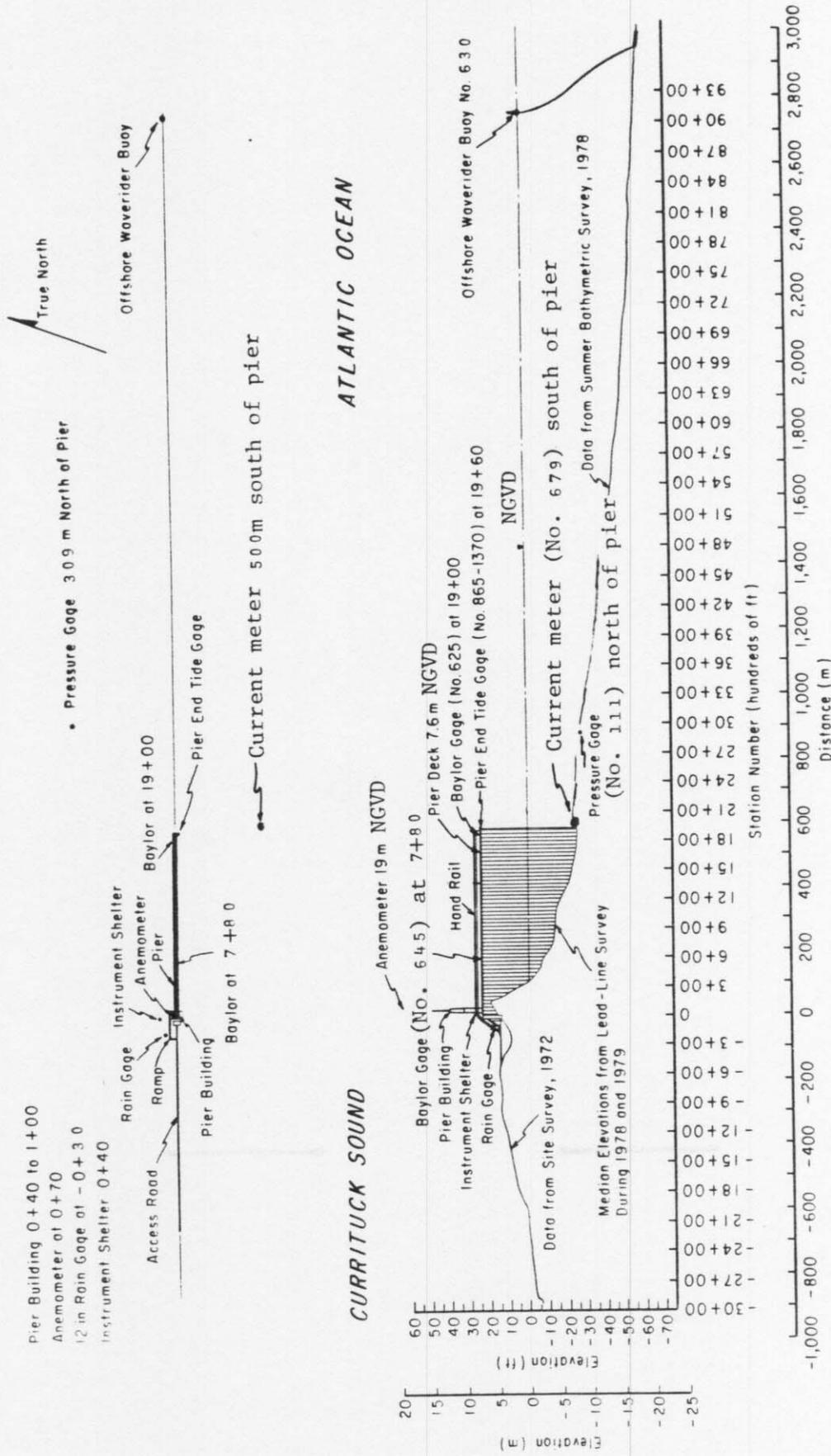


Figure 2. Instrument locations at FRF

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured on top of the laboratory building at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $\text{mm} \times .03937 = \text{in.}$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $\text{mb} \times 0.02953 = \text{in. Hg}$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $\text{m/s} \times 1.943 = \text{kn}$

Table 2: Meteorological Data

AUG 1988						
Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	5	207	23.8	1015.5	0
	700	5	237	23.6	1017.5	14
	1300	3	145	26.9	1017.9	0
	1900	2	82	24.3	1017.5	0
2	100	2	93	24.0	1018.9	0
	700	5	76	24.7	1020.9	0
	1300	4	95	28.6	1020.9	0
	1900	5	110	26.1	1020.6	0
3	100	4	125	25.2	1020.9	0
	700	6	115	25.8	1020.6	0
	1300	6	139	28.4	1021.3	0
	1900	6	158	25.9	1020.9	0
4	100	4	146	24.8	1021.6	0
	700	4	137	25.0	1021.9	0
	1300	6	147	28.1	1021.3	0
	1900	5	161	25.3	1019.9	0
5	100	3	186	22.9	1019.6	0
	700	1	110	24.3	1019.6	0
	1300	6	128	27.1	1018.6	0
	1900	3	148	23.4	1016.2	0
6	100	4	149	21.3	1014.5	0
	700	1	210	23.0	1014.2	0
	1300	2	122	27.7	1013.5	0
	1900	3	236	28.5	1012.8	0
7	100	7	256	26.4	1013.1	0
	700	4	241	25.3	1014.2	0
	1300	6	174	26.2	1014.2	0
	1900	3	212	25.6	1013.8	0
8	100	4	243	25.5	1013.5	0
	700	3	152	22.7	1015.2	0
	1300	4	143	28.5	1014.8	0
	1900	4	159	23.6	1014.8	0
9	100	4	161	22.5	1015.2	0
	700	3	116	23.9	1015.9	0
	1300	7	124	26.2	1015.9	0
	1900	5	169	26.0	1015.5	0
10	100	6	203	25.1	1016.2	0
	700	6	215	25.1	1017.5	0
	1300	7	226	27.2	1018.6	0
	1900	6	223	26.8	1018.2	0
11	100	3	231	25.3	1019.6	0
	700	4	215	26.2	1021.3	0
	1300	4	150	27.0	1020.6	0
	1900	5	192	26.8	1018.9	0
12	100	4	228	25.8	1019.9	0
	700	4	256	26.8	1020.9	0
	1300	5	147	27.9	1020.3	0
	1900	6	164	23.6	1019.6	0
13	100	4	202	25.9	1020.3	0
	700	2	133	23.6	1020.9	0
	1300	4	89	28.8	1020.6	0
	1900	6	146	24.5	1019.2	0
14	100	3	128	22.2	1019.2	0
	700	4	141	24.8	1019.6	0
	1300	5	149	29.4	1018.9	0
	1900	5	178	27.5	1016.9	0
15	100	5	206	26.4	1016.5	0
	700	7	227	26.9	1016.5	0
	1300	6	226	30.6	1014.8	0
	1900	9	213	28.6	1012.8	0
16	100	9	216	25.9	1013.1	0
	700	8	255	25.6	1014.2	0
	1300	2	85	29.1	1013.8	0
	1900	3	143	25.1	1012.8	0

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

AUG 1988						
Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
17	100	6	258	27.0	1012.8	0
	700	5	248	26.2	1013.8	0
	1300	2	102	30.6	1013.5	0
	1900	3	207	30.1	1010.1	0
18	100	10	239	28.2	1008.1	0
	700	7	288	27.8	1009.1	0
	1300	5	38	25.7	1009.8	0
	1900	3	131	24.6	1009.8	0
19	100	4	176	23.6	1010.1	8
	700	5	185	25.6	1010.1	0
	1300	4	116	28.2	1009.4	0
	1900	1	54	24.9	1008.4	0
20	100	4	33	23.4	1010.1	0
	700	7	231	26.1	1009.1	0
	1300	7	208	32.3	1006.4	0
	1900	2	83	23.1	1008.4	35
21	100	5	248	24.2	1007.7	16
	700	5	305	24.0	1008.4	0
	1300	6	16	24.6	1009.8	0
	1900	5	38	23.3	1011.8	0
22	100	5	357	22.2	1013.5	0
	700	9	30	23.2	1015.5	0
	1300	7	12	25.3	1017.5	0
	1900	8	23	22.9	1018.6	0
23	100	5	56	22.9	1018.9	0
	700	4	50	23.8	1018.9	0
	1300	5	103	26.8	1017.9	0
	1900	4	154	23.6	1015.5	0
24	100	5	173	25.0	1012.5	0
	700	5	225	23.8	1011.8	0
	1300	6	217	26.0	1009.4	0
	1900	5	207	24.4	1007.4	0
25	100	3	217	23.9	1006.7	0
	700	3	251	24.1	1007.0	0
	1300	3	90	27.7	1008.1	0
	1900	5	183	26.5	1007.4	0
26	100	4	214	24.9	1007.7	0
	700	3	226	25.4	1008.7	0
	1300	4	182	29.1	1010.4	0
	1900	6	198	25.8	1010.8	0
27	100	5	205	24.6	1013.1	0
	700	3	181	25.1	1015.9	0
	1300	3	195	26.3	1016.9	0
	1900	5	168	25.5	1017.2	0
28	100	1	188	24.4	1018.9	0
	700	4	146	24.3	1020.3	0
	1300	7	160	29.3	1019.9	0
	1900	5	146	25.4	1019.6	0
29	100	5	145	23.2	1018.6	0
	700	6	157	26.0	1017.5	4
	1300	7	169	29.2	1014.8	0
	1900	5	166	26.2	1013.5	0
30	100	5	195	25.3	1012.5	0
	700	4	29	21.2	1012.1	18
	1300	6	338	20.2	1012.8	10
	1900	8	6	20.4	1012.8	0
31	100	9	23	21.0	1013.8	0
	700	9	10	20.7	1015.9	5
	1300	9	15	20.8	1016.9	0
	1900	Software Error			1017.2	0
		Resultant		Mean	Mean	Total
		2	175	25.4	1015.2	110

(Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hrs (more frequently during storms) near 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for 34 minutes.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Aug 1988

Day	Hour	645		625		111		630	
		Baylor Hmo,m	at 7+80 T,sec	Baylor Hmo,m	at 19+00 T,sec	Pressure Hmo,m	Gage T,sec	Farshr Hmo,m	Wvrdr T,sec
1	0100	0.18	12.80	0.35	8.53	0.43	9.14	0.51	9.14
	0700	0.23	8.83	0.46	9.14	0.53	9.14	0.60	8.83
	1300	0.21	9.14	0.38	9.14	0.46	8.53	0.52	8.83
	1900	0.22	8.83	0.42	8.26	0.48	8.83	0.50	8.83
2	0100	0.21	8.83	0.39	9.48	0.52	9.14	0.54	8.53
	0700	0.28	8.53	0.45	8.53	0.57	8.83	0.62	8.83
	1300	0.28	9.14	0.45	8.53	0.54	9.14	0.55	9.14
	1900	0.31	8.83	0.53	8.53	0.63	8.53	0.63	8.00
3	0100	0.43	4.06	0.71	5.69	0.84	5.45	0.88	8.83
	0700	0.47	5.69	0.70	5.45	0.87	5.95	1.04	6.09
	1300	0.55	6.09	0.77	5.95	0.92	5.95	1.08	5.95
	1900	0.50	6.24	0.71	5.95	0.90	6.40	1.06	6.40
4	0100	0.44	5.57	0.60	5.69	0.80	5.95	0.93	5.69
	0700	0.33	3.66	0.61	8.83	0.68	5.22		*
	1300	0.42	5.33	0.59	8.83	0.70	5.57		*
	1900	0.28	5.69	0.55	9.14	0.70	8.83		*
5	0100	0.36	5.02	0.56	5.57	0.65	5.45		*
	0700	0.35	6.74	0.56	5.57	0.70	5.95	0.90	6.09
	1300	0.54	4.49	0.69	5.95	0.83	6.56	1.14	6.74
	1900	0.42	6.74	0.64	6.56	0.85	6.74	1.05	6.40
6	0100	0.46	5.57	0.66	5.22	0.84	6.40	1.08	5.82
	0700	0.38	6.24	0.62	6.24	0.75	6.74	0.93	6.09
	1300	0.40	7.53	0.57	6.40	0.78	5.95	0.83	7.11
	1900	0.23	7.53	0.43	8.53	0.59	7.11	0.66	8.00
7	0100	0.27	6.92	0.42	7.76	0.54	6.74	0.75	7.11
	0700	0.24	6.92	0.37	6.56	0.52	6.24	0.68	6.92
	1300	0.34	5.69	0.45	7.31	0.57	7.31	0.64	8.00
	1900	0.21	8.53	0.36	8.53	0.45	6.92	0.58	7.76
8	0100	0.26	6.74	0.41	7.31	0.57	6.24	0.66	6.40
	0700	0.31	6.56	0.46	6.92	0.58	6.40	0.68	6.74
	1300	0.30	7.31	0.45	7.31	0.61	7.11	0.71	7.31
	1900	0.32	6.92	0.45	6.74	0.58	6.92	0.72	6.92
9	0100	0.33	5.12	0.47	5.57	0.63	5.12	0.82	6.74
	0700	0.40	6.40	0.58	6.24	0.76	6.40	1.02	5.57
	1300	0.40	4.83	0.52	4.92	0.67	5.12	0.88	5.69
	1900	0.47	5.57	0.62	5.12	0.84	5.22	1.14	5.57
10	0100	0.37	6.24	0.53	6.40	0.69	7.11	1.08	6.24
	0700	0.44	6.40	0.60	5.82	0.76	5.82	1.12	5.69
	1300	0.33	6.92	0.47	9.85	0.61	9.85	0.90	5.57
	1900	0.34	6.56	0.47	9.48	0.56	5.82	0.86	6.40
11	0100	0.23	9.14	0.41	8.53	0.54	9.48	0.76	5.69
	0700	0.25	6.92	0.37	10.24	0.47	8.26	0.63	9.14
	1300	0.18	9.14	0.33	9.48	0.46	9.14	0.56	7.11
	1900	0.25	8.83	0.35	9.14	0.44	8.53	0.60	8.00
12	0100	0.19	2.69	0.32	9.14	0.43	8.53	0.50	8.26
	0700	0.20	8.83	0.33	8.83	0.41	7.31	0.50	8.00
	1300	0.21	8.83	0.38	9.14	0.49	8.26	0.60	8.26
	1900	0.28	8.83	0.41	8.83	0.51	8.53	0.64	8.53
13	0100	0.21	2.94	0.32	8.83	0.42	8.83	0.45	9.14
	0700	0.24	8.53	0.36	8.83	0.48	8.26	0.51	7.53
	1300	0.21	8.53	0.37	8.00	0.49	8.53	0.51	8.26
	1900	0.28	8.00	0.43	8.00	0.53	8.83	0.58	9.14
14	0100	0.28	8.53	0.43	8.53	0.60	8.53	0.65	8.83
	0700	0.38	8.53	0.54	8.53	0.68	8.53	0.75	8.83
	1300	0.31	8.83	0.46	8.83	0.62	9.14	0.73	9.14
	1900	0.42	9.14	0.53	9.48	0.71	9.48	0.85	9.85
15	0100	0.31	9.14	0.46	7.76	0.60	8.53	0.83	8.53
	0700	0.30	5.22	0.45	7.76	0.57	6.92	0.72	7.76
	1300	0.18	8.26	0.29	8.00	0.41	6.92	0.58	6.40
	1900	0.29	3.71	0.35	6.92	0.47	5.02	0.72	4.27
16	0100	0.19	3.41	0.25	7.31	0.33	8.00	0.64	5.69
	0700	0.15	6.56	0.22	7.53	0.32	6.74	0.47	6.09
	1300	0.14	13.47	0.22	8.83	0.29	6.24	0.43	5.22
	1900	0.16	12.80	0.25	12.19	0.34	8.26	0.44	5.45

* Electronic problems

(Continued)

(Sheet 1 of 2)

Table 3: Wave Data

Aug 1988

Day	Hour	645		625		111		630	
		Baylor Hmo,m	at 7+80 T,sec	Baylor Hmo,m	at 19+00 T,sec	Pressure Hmo,m	Gage T,sec	Farshr Hmo,m	Wvrdr T,sec
17	0100	0.18	4.34	0.25	13.47	0.32	13.47	0.41	4.92
	0700	0.17	4.83	0.25	4.92	0.32	12.80	0.36	5.33
	1300	0.17	12.80	0.24	8.83	0.32	8.53	0.35	8.83
	1900	0.17	8.83	0.26	8.53	0.32	8.83	0.34	8.83
18	0100	0.17	15.06	0.22	9.14	0.31	8.83	0.45	2.27
	0700	0.15	15.06	0.21	15.06	0.26	8.53	0.35	8.83
	1300	0.18	14.22	0.25	14.22	0.31	14.22	0.33	5.95
	1900	0.21	4.83	0.29	8.83	0.36	15.06	0.35	8.83
19	0100	0.40	4.92	0.51	5.57	0.53	5.33	0.57	5.22
	0700	0.38	5.95	0.56	5.22	0.55	5.69	0.55	5.82
	1300	0.36	16.00	0.49	16.00	0.49	7.53	0.53	7.76
	1900	0.32	15.06	0.50	15.06	0.50	15.06	0.53	15.06
20	0100	0.48	14.22	0.63	14.22	0.60	15.06	0.72	14.22
	0700	0.38	15.06	0.54	14.22	0.56	14.22	0.62	14.22
	1300	0.35	14.22	0.49	14.22	0.53	13.47	0.63	13.47
	1900	0.42	5.22	0.54	14.22	0.58	13.47	0.84	5.33
21	0100	0.31	12.80	0.44	13.47	0.51	12.19	0.55	13.47
	0700	0.27	13.47	0.45	12.80	0.51	12.80	0.60	7.53
	1300	0.61	3.66	0.72	12.19	0.75	3.77	0.81	4.20
	1900	0.54	4.49	0.64	4.34	0.69	4.49	0.76	8.53
22	0100	0.47	4.83	0.66	8.00	0.67	8.00	0.79	7.53
	0700	0.80	4.66	0.99	4.83	1.00	4.74	1.09	4.83
	1300	0.87	4.92	0.95	5.22	1.04	5.33	1.17	5.22
	1900	0.82	5.57	0.92	5.02	0.96	5.45	1.14	5.69
23	0100	0.82	5.69	0.95	5.69	1.00	5.82	1.14	5.82
	0700	0.63	6.09	0.77	5.95	0.77	5.95	0.93	6.40
	1300	0.52	5.95	0.79	5.82	0.79	5.95	0.87	6.09
	1900	0.46	5.95	0.76	6.09	0.76	5.82	0.94	5.95
24	0100	0.44	5.22	0.75	5.12	0.80	5.22	1.05	5.12
	0700	0.32	5.57	0.62	7.31	0.69	6.74	0.79	7.11
	1300	0.34	5.45	0.66	6.24	0.70	5.45	0.86	5.82
	1900	0.31	6.09	0.51	6.40	0.57	5.82	0.71	4.92
25	0100	0.21	6.09	0.40	5.95	0.50	5.45	0.57	5.95
	0700	0.23	8.83	0.41	6.24	0.48	7.76	0.59	8.83
	1300	0.19	7.76	0.39	11.13	0.42	7.11	0.54	6.92
	1900	0.32	7.53	0.48	7.76	0.49	7.31	0.71	7.53
26	0100	0.19	7.76	0.35	7.76	0.42	10.67	0.50	7.76
	0700	0.29	7.53	0.43	7.76	0.49	7.31	0.61	7.76
	1300	0.25	7.31	0.42	7.53	0.49	6.92	0.54	7.31
	1900	0.32	6.92	0.42	6.40	0.51	6.74	0.71	5.82
27	0100	0.20	7.11	0.34	10.24	0.42	9.85	0.59	5.69
	0700	0.37	5.69	0.51	10.24	0.57	9.85	0.67	9.85
	1300	0.30	9.48	0.52	9.85	0.59	9.48	0.71	9.48
	1900	0.40	8.26	0.55	8.83	0.60	9.48	0.74	9.14
28	0100	0.22	8.83	0.43	8.53	0.53	9.14	0.61	8.83
	0700	0.40	9.85	0.56	9.85	0.64	8.53	0.69	8.83
	1300	0.39	2.88	0.60	9.48	0.64	8.26	0.82	8.53
	1900	0.50	5.69	0.69	7.53	0.75	7.31	0.98	6.24
29	0100	0.46	8.83	0.71	8.83	0.82	8.26	1.04	8.00
	0700	0.63	5.82	0.89	8.00	0.95	8.00	1.19	6.24
	1300	0.58	8.26	0.78	8.00	0.95	8.83	1.01	6.09
	1900	0.55	8.00	0.77	8.26	0.87	8.00	0.98	8.00
30	0100	0.36	8.00	0.68	8.53	0.76	8.26	0.92	8.53
	0700	0.48	8.26	0.77	9.48	0.87	8.26	1.02	8.83
	1300	0.57	4.41	0.79	10.24	0.88	9.48	1.09	9.14
	1900	1.09	5.57	1.24	5.45	1.28	5.22	1.37	5.33
31	0100	1.04	6.09	1.31	5.95	1.37	5.95	1.40	5.12
	0700	1.06	5.82	1.23	5.95	1.25	6.09	1.29	5.33
	1300	1.10	5.95	1.34	5.82	1.33	6.40	1.65	5.69
	1900				Software Error				
	Mean	0.37	7.51	0.53	8.23	0.63	7.87	0.75	7.37
	Std dev	0.19	2.88	0.22	2.50	0.21	2.36	0.25	2.04

* Electronic problems

(Sheet 2 of 2)

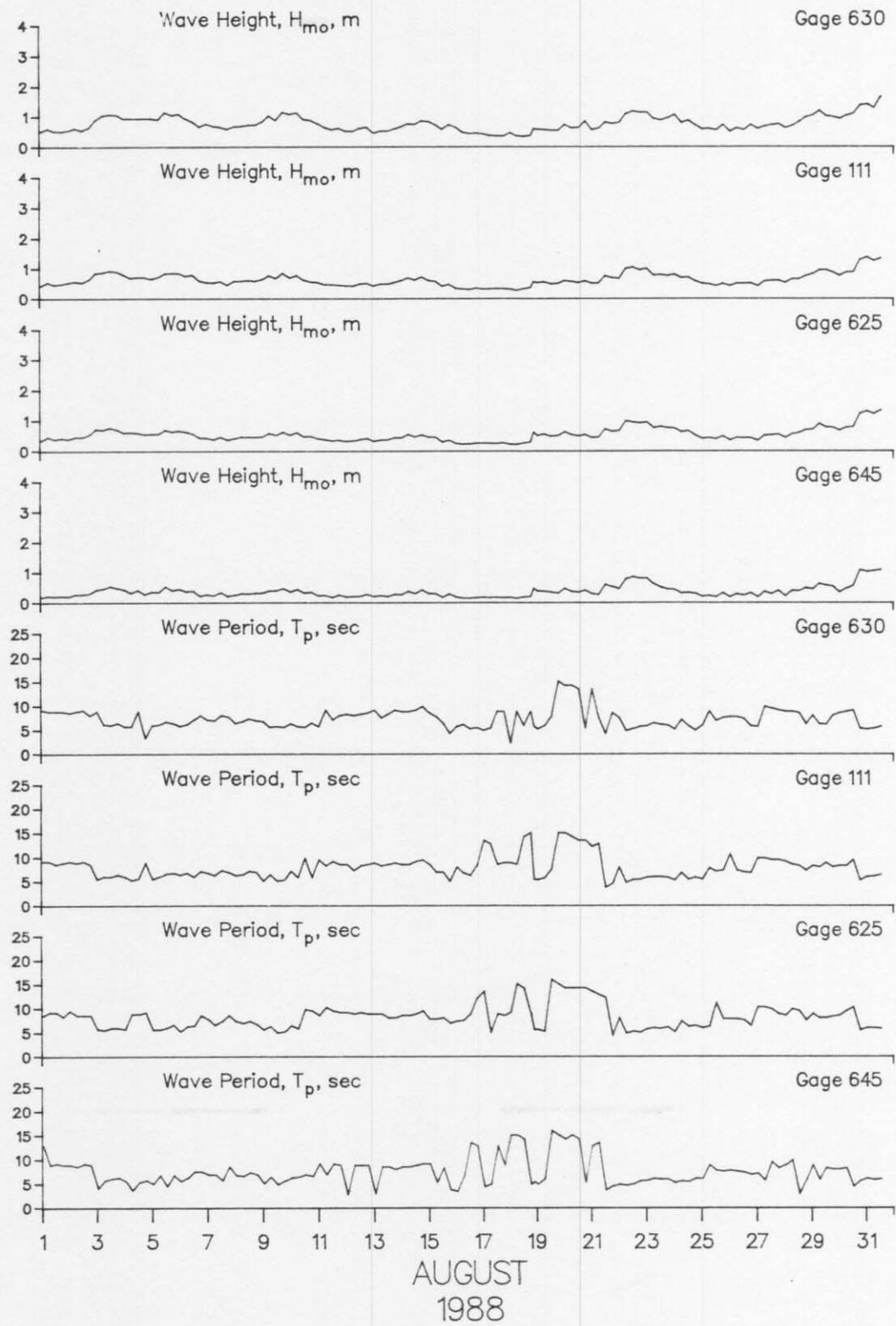


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Aug 1988

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
1	0100	Along Cross Result									1 3 3	S on 232
1	0700	Along Cross Result	8 2 8	S off 143	152	2 1 2	N off 7	South	3	N	2 5 5	N on 272
1	1300	Along Cross Result									6 2 6	S off 142
1	1900	Along Cross Result									4 1 4	S on 174
2	0100	Along Cross Result									6 1 6	S off 151
2	0700	Along Cross Result	30 18 36	S on 191	177	19 0 19	N 340	South	58	N	13 1 13	S off 156
2	1300	Along Cross Result									9 1 9	S off 154
2	1900	Along Cross Result									3 0 3	S 160
3	0100	Along Cross Result									17 3 17	S off 150
3	0700	Along Cross Result	11 5 12	S on 184	189	76 0 76	N 340	South	71	N	7 5 9	S off 124
3	1300	Along Cross Result									10 1 10	S on 166
3	1900	Along Cross Result									13 1 13	S off 156
4	0100	Along Cross Result									6 3 7	S on 187
4	0700	Along Cross Result	8 5 9	S on 191	189	51 13 52	N off 354	South	61	N	2 2 3	S off 115
4	1300	Along Cross Result									6 1 6	S on 169
4	1900	Along Cross Result									0 1 1	 on 250
5	0100	Along Cross Result									2 2 3	S on 205
5	0700	Along Cross Result	0 0 0	 0	189	68 3 68	N off 343	South	91	N	2 1 2	S on 187
5	1300	Along Cross Result									5 3 6	S on 191
5	1900	Along Cross Result									3 0 3	S 160

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1988

Day	Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679	
		Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)		Speed	Dir
6	0100-Along Cross Result							1 3 3	S on 232	
6	0700-Along Cross Result	12 0 12	S 160	201	38 11 40	N on 323	85 N	4 0 4	S 160	
6	1300-Along Cross Result							2 1 2	S off 133	
6	1900-Along Cross Result							4 1 4	S off 146	
7	0100-Along Cross Result							4 5 6	S on 211	
7	0700-Along Cross Result	0 0 0	 0	171	16 0 16	N 340	34 N	7 2 7	S on 176	
7	1300-Along Cross Result							10 5 11	S off 133	
7	1900-Along Cross Result							2 2 3	N on 295	
8	0100-Along Cross Result							5 2 5	N off 2	
8	0700-Along Cross Result	0 0 0	 0	177	51 8 51	N off 349	35 N	3 3 4	S on 205	
8	1300-Along Cross Result							2 0 2	N 340	
8	1900-Along Cross Result							1 2 2	S on 223	
9	0100-Along Cross Result							1 1 1	N on 295	
9	0700-Along Cross Result	5 0 5	S off 157	189	21 3 21	N off 349	59 N	9 2 9	S off 147	
9	1300-Along Cross Result							1 3 3	S off 88	
9	1900-Along Cross Result							0 5 5	 on 250	
10	0100-Along Cross Result							4 2 4	N on 313	
10	0700-Along Cross Result	17 10 20	N off 11	177	30 18 36	N off 11	81 N	7 4 8	S on 190	
10	1300-Along Cross Result							3 6 7	N on 277	
10	1900-Along Cross Result							4 5 6	N on 289	

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1988

Day	Alongshore Cross-shore Resultant ----- Time	Pier Measurements				Beach Measurements			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679	
		Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		Dye 12m offshore (surface)			Speed	Dir
		Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed		
16	0100-Along Cross Result								5 5 7	N on 295
16	0700-Along Cross Result	10 15 18	S off 104	152	12 4 13	N off 357	South	6 N	1 5 5	N on 261
16	1300-Along Cross Result								9 2 9	S off 147
16	1900-Along Cross Result								2 3 4	S on 216
17	0100-Along Cross Result								3 3 4	S on 205
17	0700-Along Cross Result	15 9 17	S off 129	152	28 8 29	N on 323	South	18 N	0 0 0	
17	1300-Along Cross Result								12 2 12	S off 151
17	1900-Along Cross Result								9 1 9	S on 166
18	0100-Along Cross Result								5 4 6	S on 199
18	0700-Along Cross Result	29 12 31	S off 138	165	0 9 9	off 70	South	10 S	1 0 1	S S 160
18	1300-Along Cross Result								12 4 13	S off 142
18	1900-Along Cross Result								5 4 6	S on 199
19	0100-Along Cross Result								6 1 6	S off 151
19	0700-Along Cross Result	0 0 0		189	17 10 20	N on 309	South	53 S	4 1 4	S off 146
19	1300-Along Cross Result								6 2 6	S on 178
19	1900-Along Cross Result								7 0 7	S S 160
20	0100-Along Cross Result								11 3 11	S off 145
20	0700-Along Cross Result	0 6 6	off 70	177	0 13 13	off 70	South	3 N	8 3 9	S on 181
20	1300-Along Cross Result								5 2 5	S on 182
20	1900-Along Cross Result								4 5 6	S off 109

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1988

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)		Dye 12m offshore (surface)			Speed	Dir	
			Speed	Dir	Speed	Dir	Location	Speed	Dir			
21	0100	Along Cross Result								8 4 9	S off 133	
21	0700	Along Cross Result	15 0 15	S off 160	165	28 8 29	N on 323	South	13	N	5 3 6	S on 191
21	1300	Along Cross Result									16 1 16	S off 156
21	1900	Along Cross Result									10 3 10	S off 143
22	0100	Along Cross Result									8 3 9	S on 181
22	0700	Along Cross Result	27 8 28	S off 143	213	23 16 28	S on 195	North	30	S	18 1 18	S off 157
22	1300	Along Cross Result									16 1 16	S off 156
22	1900	Along Cross Result									23 2 23	S off 155
23	0100	Along Cross Result									18 5 19	S off 144
23	0700	Along Cross Result	27 4 27	S on 169	177	0 5 5		South	12	S	15 2 15	S on 168
23	1300	Along Cross Result									10 6 12	S off 129
23	1900	Along Cross Result									4 5 6	S on 211
24	0100	Along Cross Result									3 6 7	N on 277
24	0700	Along Cross Result	10 6 11	N off 11	177	41 12 42	N off 357	South	18	N	3 1 3	S on 178
24	1300	Along Cross Result									6 5 8	N on 300
24	1900	Along Cross Result									6 0 6	N on 340
25	0100	Along Cross Result									2 2 3	N on 295
25	0700	Along Cross Result	10 8 13	S off 123	165	25 9 27	N on 321	South	2	S	6 5 8	S on 200
25	1300	Along Cross Result									3 0 3	N on 340
25	1900	Along Cross Result									1 2 2	S on 223

KEY = All speeds in CM/SEC
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on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1988

Day	Alongshore Cross-Current Result	Pilot Measurements 020-45 WIG-50 Time (surface) Distance Time Speed (Dir)				Trawl Measurements (300m-150m) Dye 12m offshore (surface) Location Speed (Dir)				Current Water at South Tripod Depth -1.0m (MWD) 20-100m	
		Size of (Dir) of (surface) (surface)	Speed (Dir)	Speed (Dir)	Speed (Dir)	Location	Speed (Dir)	Speed	Dir	Speed	Dir
27	0700-Along Cross Result	29 7 30	N on 326	165	68 0 68	N 340	South	52	N	5 7 4 8	33 S off 130
27	1300-Along Cross Result									7 5 9	N on 304
27	1900-Along Cross Result									1 4 4	N on 264
28	0100-Along Cross Result									1 2 2	N on 277
28	0700-Along Cross Result	25 3 26	N on 334	152	38 0 38	N 340	South	72	N	4 1 4	S off 146
28	1300-Along Cross Result									14 3 14	N on 328
28	1900-Along Cross Result									1 1 1	N off 25
29	0100-Along Cross Result									6 4 7	S on 194
29	0700-Along Cross Result	20 4 20	N off 351	165	76 69 103	N on 298	South	76	N	1 5 5	S on 239
29	1300-Along Cross Result									15 4 16	N on 325
29	1900-Along Cross Result									7 6 9	N on 299
30	0100-Along Cross Result									2 5 5	S on 228
30	0700-Along Cross Result	13 11 17	S on 202	165	38 0 38	N 340	South	69	N	2 4 4	N off 43
30	1300-Along Cross Result									24 2 24	S off 155
30	1900-Along Cross Result									19 0 19	S 160

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
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 on = onshore off = offshore

Table 4: Current Data (Concluded)
Aug 1988

Alongshore Cross-shore Resultant ----- Time	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679	
	Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Dye 12m offshore (surface)		Dye 12m offshore (surface)			Speed	Dir
	Speed	Dir		Speed	Dir	Location	Speed	Dir		
31 0100-Along Cross Result									22	S
									1	off
									22	157
31 0700-Along Cross Result	36	S	165	36	S	North	75	S	20	S
	18	on		22	on		5	off		
	40	187		42	191		21	146		
31 1300-Along Cross Result									26	S
									5	off
									26	149
31 1900-Along Cross Result										

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PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves). The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Aug 1988

Day	Time	Wave Approach Angle at Pier End deg from True N		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	0804	120			31	22.0	1.0250	4.0
2	0630	90	30		90	23.6	1.0230	6.7
3	0630	90	60	90	94	26.1	1.0200	6.1
4	0640	130	90		63	22.8	1.0222	4.6
5	0700	120			89	21.1	1.0240	4.6
6	0845	120	90		85	20.6	1.0245	3.7
7	0520	120	90		45	20.0	1.0246	2.7
8	0703	100			85	23.9	1.0228	6.4
9	0616	105			83	20.0	1.0240	6.1
10	0722	105			51	20.0	1.0252	2.7
11	0711	100			40	20.0	1.0260	4.3
12	0651	110			28	19.5	1.0244	4.6
13	0800	120	90		52	18.4	1.0255	5.8
14	0804	90			51	20.0	1.0254	4.0
15	0651	100			52	18.9	1.0260	2.7
16	0730	90			30	20.6	1.0258	3.7
17	0700	90			45	21.4	1.0258	4.3
18	0702	150			28			4.9
19	0708	90			69	23.4	1.0236	5.5
20	0828	95			39	25.0	1.0230	5.2
21	0802	90			37	23.9	1.0220	4.9
22	0720	45	40	60	61	22.2	1.0218	3.7
23	0636	70		63	55	22.8	1.0200	4.0
24	0715	90			49	22.8	1.0226	3.7
25	0713	90		inoperative	48	23.9	1.0238	5.5
26	0548	95			37	23.4	1.0238	6.1
27	0926	100			49	23.9	1.0244	6.4
28	0801	100			24	23.9	1.0240	7.9
29	0637	80		100	28	21.1	1.0250	3.0
30	0708	80	60	95	22	18.9	1.0254	2.4
31	0716	25		80	37	22.2	1.0246	4.9

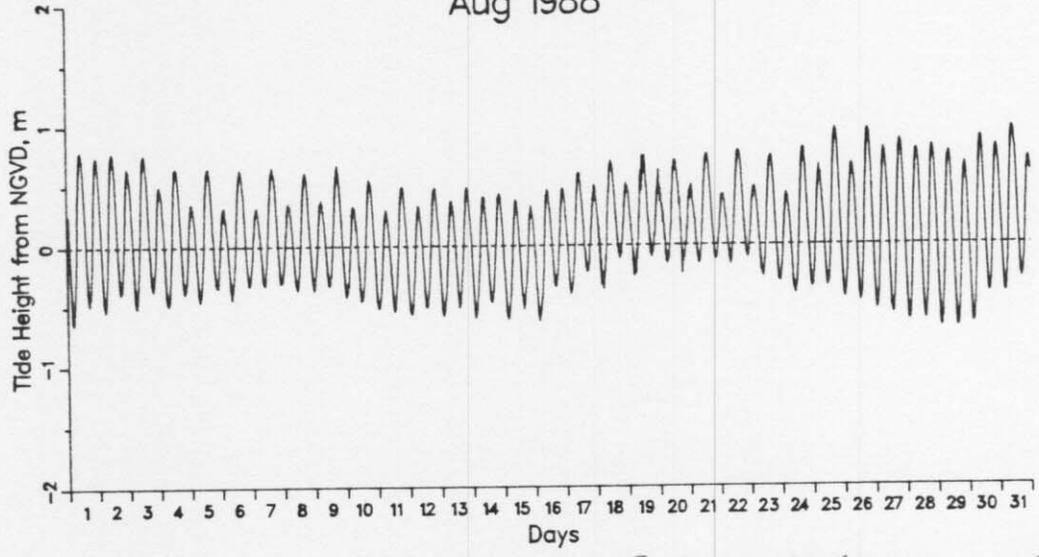
PART VI: WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours) and contains a list of selected mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights
Aug 1988



Water level time history

Figure 4. ~~Time history of mean water levels~~

Monthly Water Levels, m NGVD

Extreme Low	=	-0.69	on day 29 at	200 hr
Extreme High	=	0.97	on day 31 at	936 hr
Monthly Mean	=	0.10		
Mean Low	=	-0.41		
Mean High	=	0.61		
Mean Range	=	1.03		

Table 6: Water Levels,m NGVD

		Aug 1988			
Mid-Cycle Day	Time	Low	High	Mean	Range
1	612	-0.64	0.79	0.10	1.44
1	1837	-0.49	0.75	0.15	1.23
2	703	-0.53	0.78	0.13	1.31
2	1928	-0.39	0.66	0.14	1.05
3	753	-0.51	0.76	0.14	1.26
3	2018	-0.36	0.50	0.09	0.86
4	843	-0.48	0.65	0.08	1.13
4	2109	-0.39	0.36	0.01	0.75
5	934	-0.46	0.65	0.09	1.11
5	2159	-0.34	0.41	0.02	0.75
6	1024	-0.44	0.63	0.09	1.07
6	2249	-0.33	0.44	0.03	0.77
7	1115	-0.33	0.66	0.15	0.98
7	2340	-0.30	0.47	0.05	0.78
8	1205	-0.36	0.61	0.10	0.97
9	30	-0.37	0.41	0.04	0.77
9	1255	-0.33	0.67	0.12	1.00
10	121	-0.42	0.45	-0.01	0.87
10	1346	-0.46	0.55	0.02	1.01
11	211	-0.52	0.33	-0.08	0.85
11	1436	-0.54	0.49	-0.02	1.04
12	301	-0.57	0.33	-0.11	0.90
12	1527	-0.51	0.48	-0.02	0.99
13	352	-0.58	0.37	-0.09	0.95
13	1617	-0.51	0.48	0.00	1.00
14	442	-0.60	0.41	-0.08	1.01
14	1707	-0.47	0.43	-0.02	0.90
15	532	-0.61	0.38	-0.12	0.98
15	1758	-0.53	0.33	-0.09	0.86
16	623	-0.63	0.46	-0.09	1.09
16	1848	-0.34	0.47	0.06	0.81
17	713	-0.40	0.60	0.10	1.00
17	1938	-0.22	0.50	0.12	0.72
18	804	-0.37	0.70	0.19	1.07
18	2029	-0.11	0.52	0.20	0.62
19	854	-0.26	0.74	0.25	1.00
19	2119	-0.10	0.62	0.22	0.72
20	944	-0.15	0.70	0.29	0.85
20	2210	-0.23	0.50	0.19	0.73
21	1035	-0.15	0.75	0.31	0.90
21	2300	-0.12	0.42	0.17	0.54
22	1125	-0.16	0.78	0.32	0.94
22	2350	-0.10	0.48	0.21	0.58
23	1216	-0.26	0.73	0.24	0.99
24	41	-0.30	0.43	0.08	0.73
24	1306	-0.40	0.80	0.18	1.20
25	131	-0.35	0.66	0.15	1.00
25	1356	-0.34	0.96	0.30	1.30
26	222	-0.44	0.67	0.15	1.11
26	1447	-0.47	0.96	0.24	1.43
27	312	-0.53	0.80	0.15	1.33
27	1537	-0.57	0.87	0.15	1.44
28	402	-0.63	0.79	0.10	1.41
28	1628	-0.62	0.82	0.10	1.44
29	453	-0.69	0.76	0.05	1.45
29	1718	-0.69	0.67	0.00	1.36
30	543	-0.66	0.89	0.11	1.55
30	1808	-0.40	0.82	0.22	1.22
31	634	-0.41	0.97	0.30	1.37
31	1859	-0.28	0.72	0.21	1.00

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in July and the one survey in August on profile line 188, located 517 m south of pier. Only minor changes are visible on the profile.

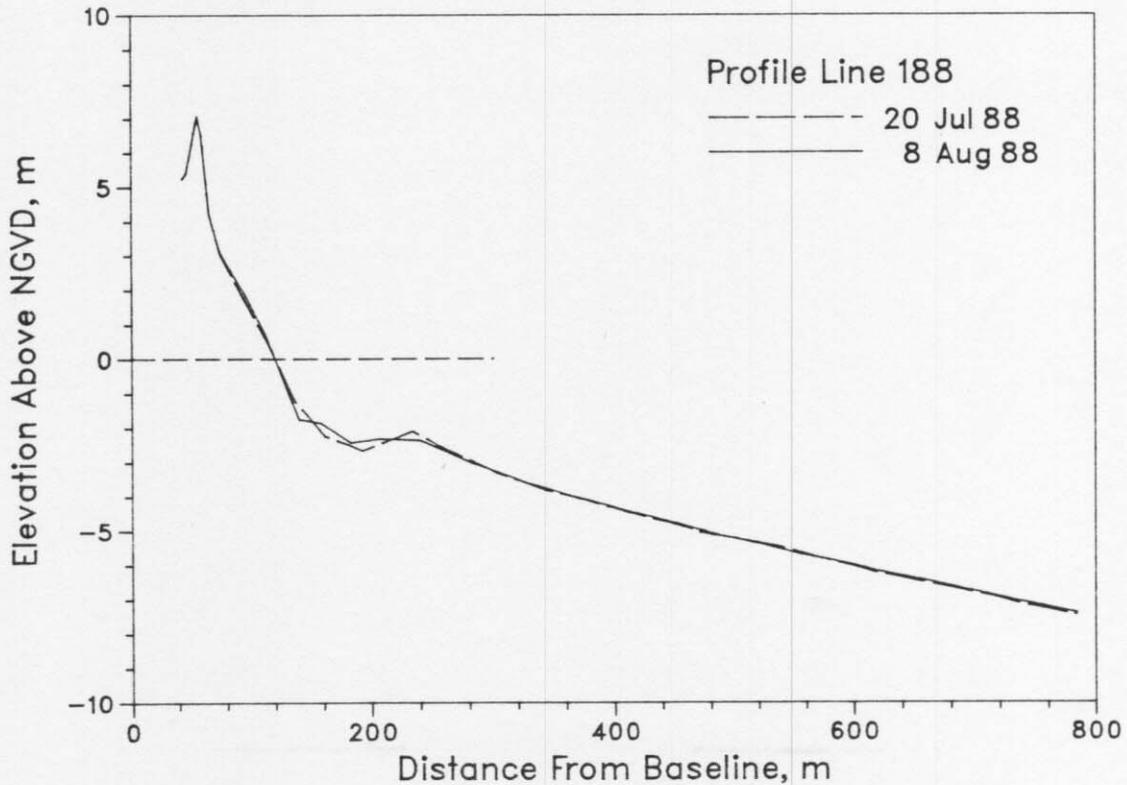


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1988. The only change is a small amount of accretion on the foreshore (80 to 120 m).

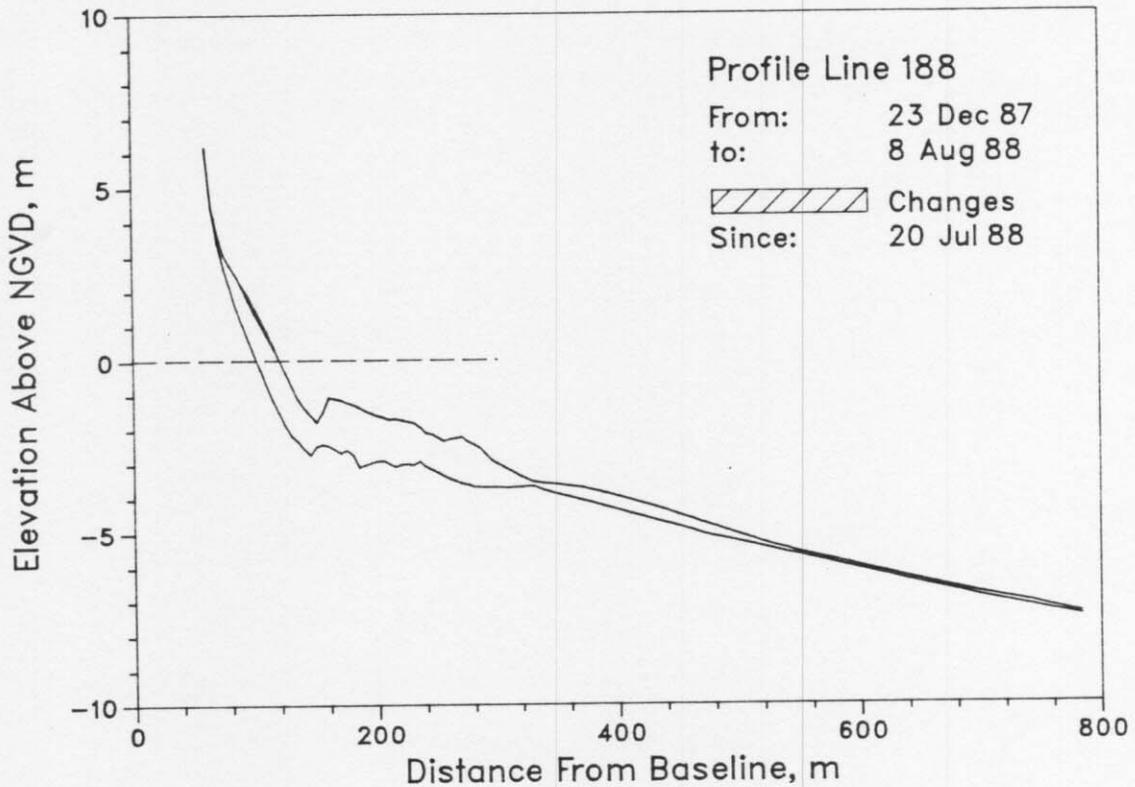


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey conducted on 8 July (no survey was conducted in August). Wide contour lines on the change diagram represent areas which eroded; thin lines indicate accretion.

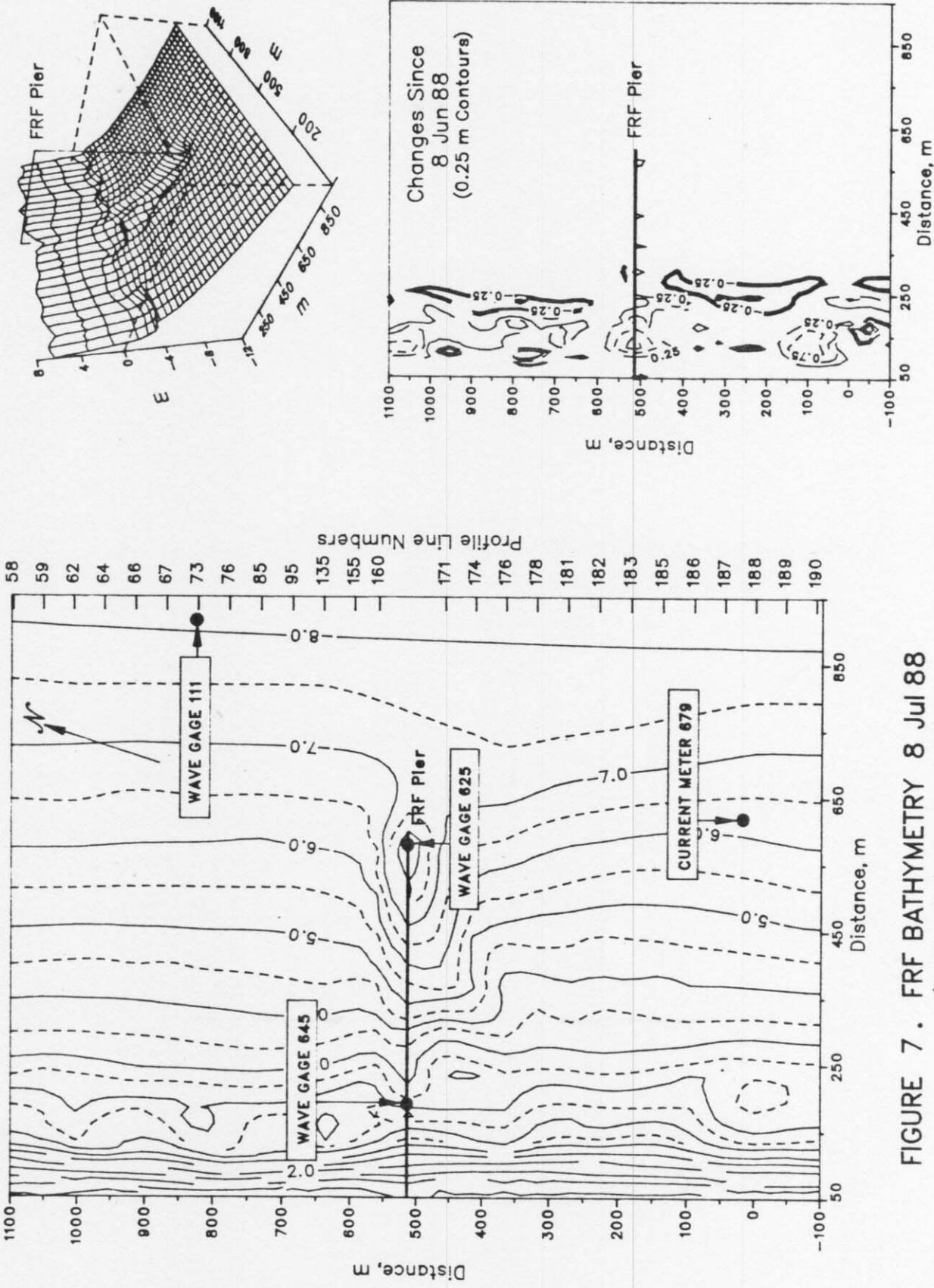


FIGURE 7 . FRF BATHYMETRY 8 Jul 88
(Depths Relative to NGVD)

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